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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte GARO J. DERDERIAN
and GURTEJ S. SANDHU

Appeal 2008-3025
Application 10/715,628
Technology Center 1700

Decided: September 18, 2008

Before CHUNG K. PAK, THOMAS A. WALTZ, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 1 through 17, all of the claims pending in the above-identified application. We have jurisdiction pursuant to 35 U.S.C. § 6.

We AFFIRM-IN-PART.

STATEMENT OF THE CASE

The subject matter on appeal is directed to a deposition system. The Figure of the application illustrates a deposition chamber 12 having a first inlet 16 and a second inlet 34; a first containment reservoir 14 external to the deposition chamber 12; a second containment reservoir 30 external to the deposition chamber 12; and carrier gas sources 22 and 36 for supplying carrier gas through the first inlet 16 and second inlet 34, respectively (Spec. ¶¶ [0018]-[0028]).

Further details of the appealed subject matter are recited in representative claims 1, 13, and 17, which are reproduced below:

1. A deposition system comprising:

a deposition chamber having an inlet port;

a first reservoir external to the deposition chamber configured for containment of a first metastable specie, the first reservoir comprising an outlet port in selective fluid communication with the inlet port of the deposition chamber; and

a metastable-specie generating catalyst within the first reservoir.

13. A deposition apparatus comprising:

a deposition chamber having a first volume;

at least one containment reservoir disposed external to the deposition chamber, fluidly connected to the deposition chamber and having a second volume, the second volume being at least about 1 % of the first volume;

a remote metastable specie source in fluid communication with at least one of the containment reservoirs.

17. An atomic layer deposition apparatus comprising:

a deposition chamber having a first inlet, a second inlet, a dispersion head, and a substrate platform; the dispersion head being positioned between the first inlet and the substrate platform and between the second inlet and the substrate platform;

a first activated specie containment reservoir external to the deposition chamber and in fluid communication with the deposition chamber through the first inlet;

a second activated specie containment reservoir external to the deposition chamber and in fluid communication with the deposition chamber through the second inlet; and

one or more carrier gas sources configured to deliver carrier gas through at least one of the first inlet and the second inlet.

As evidence of unpatentability of the claimed subject matter, the Examiner has relied upon the following references:

Gadgil	5,284,519	Feb. 8, 1994
Lee	6,086,679	Jul. 11, 2000

The Examiner has rejected the claims on appeal as follows:

1) Claims 1-3, 5-11, and 17 under 35 U.S.C. § 102(b) as anticipated by the disclosure of Gadgil; or alternatively, under 35 U.S.C. § 103(a) as unpatentable over the disclosure of Gadgil in view of (if necessary) the disclosure of Lee; and

2) Claims 4, and 12-16 under 35 U.S.C. § 103(a) as unpatentable over the disclosure of Gadgil in view of (if necessary) the disclosure of Lee.

Appellants appeal from the Examiner's decision rejecting the claims on appeal under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a)[1].

ISSUES

The Examiner first contends (Ans. 3-8 and 9-10) that Gadgil alone, or in combination with Lee, teaches or would have suggested all of the limitations recited in claim 1. Appellants, on the other hand, argue (Br. 10 and 12) that Gadgil alone, or in combination with Lee, does not teach, nor would have suggested the limitation "the first reservoir comprising an outlet port in selective fluid communication with the inlet port of the deposition chamber" recited in claim 1.

The first issue is, therefore, has the Examiner demonstrated that Gadgil alone, or in combination with Lee, teaches or would have suggested the limitation "the first reservoir comprising an outlet port in selective fluid communication with the inlet port of the deposition chamber" recited in claim 1?

The Examiner also determines (Ans. 3-8) that Gadgil alone, or in combination with Lee, teaches or would have suggested all of the limitations recited in claim 17. Appellants, on the other hand, contend (App. Br. 8-11) that Gadgil alone, or in combination with Lee, does not teach, nor would

[1] We decline to consider Appellants' arguments directed to the Examiner's objection to the drawings inasmuch as Appellants' proper remedy is through a timely petition to the Commissioner under 37 C.F.R. §1.181 and not through an appeal to the Board. *See also Manual of Patent Examining Procedure* §§ 1002, 1002.02(c), and 1201.

have suggested the limitations "deposition chamber," "first. . .containment reservoir," "second. . . containment reservoir," and "one or more carrier gas sources configured to deliver carrier gas" recited in claim 17.

The second issue is, therefore, whether Gadgil alone, or in combination with Lee, teaches or would have suggested the limitations "deposition chamber," "first. . . containment reservoir," "second. . . containment reservoir," and "one or more carrier gas sources configured to deliver carrier gas" recited in claim 17?

Lastly, the Examiner determines (Ans. 9-10) that Gadgil and Lee would have suggested all of the limitations recited in claim 13. Appellants contend (Br. 12) that "Lee is indicated as being relied upon as disclosing a heat source for heating a catalyst. However, such teaching when combined with Gadgil fails to contribute toward suggesting the claim 13 recited [sic, recitation] at least one containment reservoir where the containment reservoir has a volume which is at least about 1% of the volume of the deposition chamber."

The fourth issue is, therefore, whether Gadgil and Lee would have suggested the limitation "the second volume [of at least one containment reservoir] being at least 1% of the first volume [of the deposition chamber]" recited in claim 13?

RELEVANT FINDINGS OF FACT (FF)

1. The Specification at ¶ [0019] states that

> "selective fluid communication" refers to fluid communication which can be selectively halted to result in fluid isolation of a reservoir or other compartment from the deposition chamber.

> Selective fluid communication from reservoirs 14 and 30 can comprise communication from reservoir outlet ports 18 and 32 respectively and through inlet ports 16 and 34 of deposition chamber 12. Selective fluid communication between reservoirs 14 and 30, and deposition chamber 12 can be achieved by providing independent deposition chamber inlet ports 16 and 34 in selective fluid communication with respective reservoir outlet ports 18 and 32, as shown in the figure, or alternatively can be through a common inlet port (not shown) which provides selective fluid communication from both reservoir 14 and reservoir 30 into deposition chamber 12.

2. The Specification at ¶ [0022] states:

> Reservoirs 14 and 30 can be configured for containment of the one or more metastable precursors. For purposes of the present description, the one or more reservoirs can alternatively be referred to as reservoirs, as containment reservoirs, or as metastable-specie-containment reservoirs. Containment of the metastable precursors within the reservoirs can comprise halting selective fluid communication from the reservoirs, and can comprise, for instance, closing a valve 48 that can be positioned between reservoir outlets 18, 32 and the corresponding deposition chamber inlet 16, 34. Although the Figure shows a valve, it is to be understood that numerous alternative isolation methods can be utilized.

3. The Specification at ¶ [0011] states:

> Atomic layer deposition (ALD) involves formation of successive atomic layers on a substrate. Such layers may comprise an epitaxial, polycrystalline, amorphous, etc. material. ALD may also be referred to as atomic layer epitaxy, atomic layer processing, etc. Further, the invention may encompass other deposition methods not traditionally referred to as ALD, for example, chemical vapor deposition (CVD), but nevertheless including the method steps described herein.

4. The Specification at ¶ [0021] states that "'metastable' can refer to any metastable form of a precursor material, including but not limited to an activated form."
5. The Specification at ¶ [0022] states "[c]ontainment of the metastable precursors within the [activated specie containment] reservoirs can comprise halting selective fluid communication from the reservoirs . . ."
6. Gadgil's Figures 1 and 2 are reproduced below:

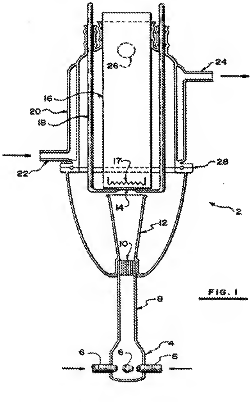

FIG. 1

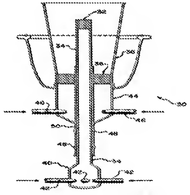
FIG. 2

7. Gadgil's Figure 1 depicts (col. 4, l. 7 to col. 4, l. 62) a chemical vapor deposition reactor system with a nozzle and Figure 2 depicts (col. 4, l. 63 to col. 5, l. 14) an "alternative reactor design" illustrating a

composite nozzle positioned "just below the surface of the substrate [14]."

8. Gadgil at col. 4, ll. 7-35 states:

> The reactor design shown in FIG. 1 consists of a mixing chamber 4 at the bottom of the reactor 2. The mixing chamber 4 consists of a glass chamber and several nozzles 6 for gas inlet in radial positions. The tangential nozzle geometry brings about rapid mixing of flows of different vapour constituents and a diluent gas by circumpherentially arranging the gas inlets to point in the same direction away from each other. This generates a vortex in the chamber 4 and ensures rapid and uniform mixing.
>
> The gas mixture then proceeds upwardly through tube 8 and encounters a plug 10 made up of a bundle of fine capillaries (O.D.=1 mm, I.D.=0.7 mm) of equal length. The most important aspect of this capillary design feature is the resulting streamlined and uniform axial distribution of gas mixture and concurrent removal of the vortex created in the chamber 4 and tube 8. The upflowing gas that emerges from the capillary plug nozzle 10 enters a carefully optimized, gradually widening diffuser 12. The guidelines for the design and stability of the diffuser 12 are discussed later in this disclosure.
>
> The gas that leaves the diffuser 12 impinges vertically upwardly onto a horizontal substrate 14 that faces downwards. The substrate 14 is attached to a resistively heated, quartz encapsulated graphite block heater 16 by means of a pair of quartz pins 18. The heating element 17 is proximate to the substrate 14.

9. Gadgil at col. 4, l. 63 to col. 5, l. 14 states:

> ALTERNATIVE EMBODIMENT
>
> In chemical gas vapor deposition processes one encounters at times reactants which react instantly upon mixing. To deal with this potential problem, the reactants are mixed in the alternative reactor design illustrated in FIG. 2 just below the surface of the substrate by separately admitting them in the reactor by a composite nozzle. The composite nozzle 30 consists of capillaries

> 32 placed in a centre tube 34 which extends into the diffuser 36. The remaining area of the composite nozzle 30 at the base of the diffuser 36 has a second group of capillaries 38 to control the gas flow through this part of the nozzle. The centre tube 34 has a vortex mixing chamber 40 with tangential nozzles 42 at the bottom. Another mixing chamber 44 is located below the capillary group 38, with tangential nozzles 46. O rings 48 seal the space between the central tube 34 and an outer separator tube 50 and permit vertical adjustment of the central tube 32.

10. Gadgil teaches at col. 1, ll. 52-54 "[t]he chemical vapor deposition reactor also comprises a gas mixing chamber with gas entry ports into the mixing chamber . . ."
11. Gadgil teaches (col. 8, ll. 55 to col. 12, l. 25) in one embodiment mixing 100 cc/min of reactant and 5 l/min of carrier gas in the mixing chamber and depositing the mixing gas onto a surface in the reactor.
12. Gadgil teaches (col. 6, ll. 66-68) "[s]cale up of such a system for large area uniform deposition could be achieved without any apparent difficulty."
13. Gadgil at col. 2, ll. 22-29 states:

    > The reactor can have two mixing chambers, one mixing chamber mixing reactor gases and delivering them to a first capillary plug; and the second mixing chamber mixing separate reactor gases and delivering them to a second capillary plug, the separate reactive gases being mixed after passing through the first and second capillary plugs into an outwardly diverging conical diffuser chamber.

14. Gadgil at col. 5, ll. 4-11 states:

    > The remaining area of the composite nozzle 30 at the base of the diffuser 36 has a second group of capillaries 38 to control the gas flow through this part of the nozzle. The centre tube 34 has a

> vortex mixing chamber 40 with tangential nozzles 42 at the bottom. Another mixing chamber 44 is located below the capillary group 38, with tangential nozzles 46.

15. Gadgil at col. 7, ll. 14-38 states:

> SYSTEM DESIGN AND ANALYSIS
> The system design is subdivided into three sections as (a) Heater design (b) Optimization of reactor parameters and (c) Fluid Dynamical model of the reactor. The Heater is an integral part of an metal organic chemical vapor deposition MOCVD reactor chamber, since its design, operation and control are crucial in determining the quality of the film deposited and in turn the electrical, optical or mechanical properties of the film. *The MOCVD reactor is the chamber where the reactant vapors are transported from outside in measured and predetermined quantities with a carrier gas* and a chemical reaction is induced on the heated surface among the constituent vapors flowing over it. This results in a solid, uniform, thin and well adherent crystal-line film on the heated surface as one of the reaction products. The other reaction products, which are gaseous, leave the reactor through the exit port. These products are subsequently either scrubbed or absorbed on a catalytic charcoal and the remnant carrier gas such as $He/N_2/Ar$ or H_2 is vented to atmosphere. The complete system, including the source materials (which are liquids at room temperature), flow meters, carrier gas tubing, gas distribution manifold, the reactor and the exhaust gas scrubbing columns, etc. is placed inside a fumehood for safety. [Emphasis added.]

PRINCIPLES OF LAW

Under 35 U.S.C. § 102(b), "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). "Inherency,

however, may not be established by probabilities or possibilities. *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981). "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (BPAI 1990)(citations omitted).

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations, if any. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). "[A]nalysis [of whether the subject matter of a claim would have been obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007). "[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art." *See In re Boesch*, 617 F.2d 272, 276 (CCPA 1980).

ANALYSES

Rejection (1): Claims 1-3, 5-11, and 17 under § 102(b) or § 103(a) [2]

[2] In each of these grounds of rejection, Appellants base their arguments for patentability solely on the limitations of claims 1 and 17. Therefore, we select claims 1 and 17 as the representative claims consistent with 37 C.F.R. § 41.37(c)(1)(vii).

Claim 1

In applying the above principles of law to the present facts, we determine that the Examiner has not established a prima facie case of anticipation or obviousness.

We begin by noting that Appellants define the claimed term "selective fluid communication" as "fluid communication which can be selectively halted to result in fluid isolation of a reservoir or other compartment from the deposition chamber." (FF 1)(emphasis added). Appellants further indicate that selectively halting involves using "a valve 48 that can be positioned between reservoir outlets 18, 32 and the corresponding deposition chamber inlet 16, 34 . . . [or] numerous [other] alternative isolation methods". (FF 2). Thus, claim 1 requires at least a valve or other functionally equivalent isolation devices be disposed between the outlet port of the first reservoir and the inlet port of the deposition chamber.

The Examiner, however, does not direct us to any teaching or suggestion in Gadgil and/or Lee regarding the employment of a valve or an equivalent isolation device between the outlet port of the first reservoir and the inlet port of the deposition chamber. Nor does the Examiner explain why it would have been obvious to employ a valve or other equivalent isolation devices to provide selective fluid communication between the outlet port of the first reservoir and the inlet port of the deposition chamber in the system taught or suggested by Gadgil and/or Lee.

Accordingly, for the reasons stated by Appellants in the Brief and above, we reverse the Examiner's decision rejecting claims 1-3 and 5-11 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a).

Claim 17

Gadgil teaches a chemical vapor deposition reactor 2 comprising a reaction chamber (deposition chamber) having first and second inlets defined by the openings of a center tube 34 and capillaries 38, respectively; capillaries 32 (dispersion head); and a substrate14 attached to a block heater 16 (substrate platform). (FF 6-9). The capillaries 32 (dispersion head) are positioned between the opening of the center tube 34 and the substrate 14 attached to the block heater 16 (substrate platform) and between the openings of the capillaries 38 (second inlet) and the substrate attached to the block heater 16 (substrate platform). *Id.* We note that Figure 2 illustrates a close-up view of an alternative arrangement to the diffuser 12 shown in Figure 1, which is located underneath the substrate 14. (FF 6).

In addition, Gadgil teaches a vortex mixing chamber 40 for a first reactant (first activated specie containment reservoir) and another mixing chamber 44 for a second reactant (second activated specie containment reservoir) external to the reaction chamber (deposition chamber). (FF 6-10). While the first reactant flows (fluid communication) from the vortex mixing chamber 40 to the reaction chamber via the opening of the center tube 34, the second reactant flows from another mixing chamber 44 to the reaction chamber (deposition chamber) via the openings of the capillaries 38. *Id.* Our interpretation that the vortex mixing chamber 40 and the other mixing chamber 44 read on the claimed terms "first. . . containment reservoir" and “second. . . containment reservoir,” respectively, is consistent with the

Specification as it describes a containment reservoir as a container having an opening for gas flow. (FF 2).

In any event, Gadgil also teaches that each of these mixing chambers 40 and 44 has gas entry ports that mixes "flows of different vapour constituents and a diluent gas [carrier gas]." (FF 7, 10, 13-15). Implicit in this statement is that separate gas sources, including external reactant containment reservoirs, are provided to supply the different reactant constituents and diluent gas [carrier gas] in the mixing chambers. Thus, we determine that Gadgil necessarily or implicitly teaches one or more carrier gas sources and external containment reservoirs configured to deliver carrier gas and reactants through the first and second inlets as required by claim 17.

We note that Appellants do not dispute the Examiner's determination that Gadgil's chemical vapor deposition reactor 2 reads on the claimed "atomic layer deposition apparatus." (*Compare* Ans. 5 *with* Br. 9-13). In this regard, the Specification states that atomic layer deposition "may encompass other deposition methods not traditionally referred to as ALD, for example, chemical vapor deposition (CVD) . . ." (FF 3).

Accordingly, based on the Factual Findings set forth in the Answer and above, we affirm the Examiner's decision rejecting claim 17 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a).

Rejection (2): Claims 4, and 12-16 under § 103(a)[3]

Claim 4

[3] We select claims 4 and 13 as the representative claims consistent with 37 C.F.R. § 41.37(c)(1)(vii).

Appellants argue (Br. 12) that dependent claim 4 is "allowable over the combination of Gadgil and Lee for at least the reason that [it] depend[s] from allowable base claim 1," which requires selective fluid communication between the outlet port of the first reservoir and the inlet port of the deposition chamber. As indicated *supra*, the Examiner has not pointed to any teaching in Gadgil and Lee, which would have suggested a valve or an equivalent isolation device to meet the functional limitation "selective fluid communication" recited in independent claim 1.

Thus, based on the same Factual Findings and conclusions set forth above, we agree with Appellants that Gadgil and Lee fail to render the subject matter recited in claims 4 and 12 obvious to one of ordinary skill in the art within the meaning of 35 U.S.C. § 103(a).

Accordingly, based on the Factual Findings set forth in the Answer and above, we reverse the Examiner's decision rejecting claims 4 and 12 under 35 U.S.C. § 103(a).

Claim 13

We determine that Gadgil would have suggested the claimed volumes of the containment reservoir and the deposition chamber required by claim 13. Gadgil's Figures 1 and 2 illustrate the vortex mixing chamber 40 or another mixing chamber 44 (at least one containment reservoir) having a volume encompassed by "at least about 1%" of the volume of the reaction chamber (deposition chamber) as required by claim 13. (FF 6). Thus, we find that Gadgil's Figures 1 and 2 meet the claimed limitation regarding the volume of the vortex mixing chamber 40 or another mixing chamber 44 (at

least one containment reservoir) and the volume of the reaction chamber (deposition chamber).

To the extent that Gadgil's Figures 1 and 2 do not illustrate the claimed volumes of at least one containment reservoir and the deposition chamber, the outcome of this decision would not be altered. Gadgil teaches that the mixing chamber 40 and the reaction chamber (deposition chamber) are sized to accommodate the optimum volume of the gas mixture. (FF 11-12, and 15). Implicit in this teaching is that the volume of at least one containment reservoir must be sufficient to deliver the optimum volume of reactants to a given volume of the reaction chamber. In other words, the volumes of at least one reactant containment reservoir and the reaction chamber are result effective variables.

Thus, we determine that the determination of the optimum volumes, including the claimed volumes, of the reactant containment reservoirs and the reaction chamber via routine experimentation is well within the ambit of one of ordinary skill in the art.

Accordingly, based on the Factual Findings set forth in the Answer and above, we affirm the Examiner's decision rejecting claims 13-16 under 35 U.S.C. § 103(a).

ORDER

In summary:

1. The §§ 102(b) and 103(a) rejections of claims 1-3 and 5-11 are reversed;
2. The §§ 102(b) and 103(a) rejections of claim 17 are affirmed;

3. The § 103(a) rejection of claims 4 and 12 is reversed; and
4. The § 103(a) rejection of claim 13-16 is affirmed.

Accordingly, the decision of the Examiner is affirmed-in-part.

TIME PERIOD

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED-IN-PART

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